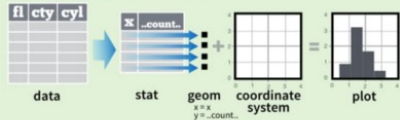


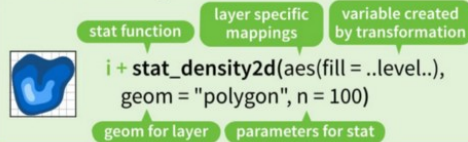
Stats - An alternative way to build a layer

Some plots visualize a **transformation** of the original data set. Use a **stat** to choose a common transformation to visualize, e.g. `a + geom_bar(stat = "bin")`



Each stat creates additional variables to map aesthetics to. These variables use a common `..name..` syntax.

stat functions and geom functions both combine a stat with a geom to make a layer, i.e. `stat_bin(geom="bar")` does the same as `geom_bar(stat="bin")`



1D distributions

- `a + stat_bin(binwidth = 1, origin = 10)`
- `x, y | ..count.., ..density.., ..ndensity..`
- `a + stat_bin2d(binwidth = 1, binaxis = "x")`
- `x, y | ..count.., ..ndensity..`
- `a + stat_density(adjust = 1, kernel = "gaussian")`
- `x, y | ..count.., ..density.., ..scaled..`

2D distributions

- `f + stat_bin2d(bins = 30, drop = TRUE)`
- `x, y, fill | ..count.., ..density..`
- `f + stat_binhex(bins = 30)`
- `x, y, fill | ..count.., ..density..`
- `f + stat_density2d(contour = TRUE, n = 100)`
- `x, y, color, size | ..level..`

3 Variables

- `m + stat_contour(aes(z = z))`
- `x, y, z, order | ..level..`
- `m + stat_spoke(aes(radius = z, angle = z))`
- `angle, radius, x, yend, yend | ..x.., ..xend.., ..y.., ..yend..`
- `m + stat_summary_hex(aes(z = z), bins = 30, fun = mean)`
- `x, y, z, fill | ..value..`
- `m + stat_summary2d(aes(z = z), bins = 30, fun = mean)`
- `x, y, z, fill | ..value..`

Comparisons

- `g + stat_boxplot(coef = 1.5)`
- `x, y | ..lower.., ..middle.., ..upper.., ..outliers..`
- `g + stat_ydensity(adjust = 1, kernel = "gaussian", scale = "area")`
- `x, y | ..density.., ..scaled.., ..count.., ..n.., ..violinwidth.., ..width..`

Functions

- `f + stat_ecdf(n = 40)`
- `x, y | ..x.., ..y..`
- `f + stat_quantile(quantiles = c(0.25, 0.5, 0.75), formula = y ~ log(x), method = "rq")`
- `x, y | ..quantile.., ..x.., ..y..`
- `f + stat_smooth(method = "auto", formula = y ~ x, se = TRUE, n = 80, fullrange = FALSE, level = 0.95)`
- `x, y | ..se.., ..x.., ..y.., ..ymin.., ..ymax..`

General Purpose

- `ggplot() + stat_function(aes(x = -3:3), fun = dnorm, n = 101, args = list(sd = 0.5))`
- `x | ..y..`

- `f + stat_identity()`
- `ggplot() + stat_qq(aes(sample = 1:100), distribution = qt, dparams = list(df = 5))`
- `sample, x, y | ..x.., ..y..`
- `f + stat_sum()`
- `x, y, size | ..size..`
- `f + stat_summary(fun.data = "mean_cl_boot")`
- `f + stat_unique()`

Scales

Scales control how a plot maps data values to the visual values of an aesthetic. To change the mapping, add a custom scale.



General Purpose scales

Use with any aesthetic:
alpha, color, fill, linetype, shape, size

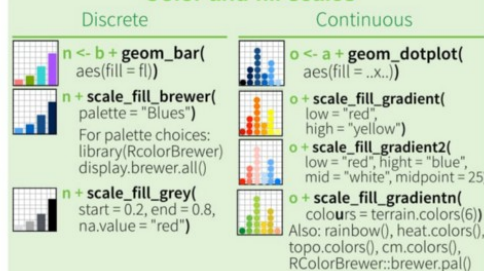
- `scale_*_continuous()` - map cont' values to visual values
- `scale_*_discrete()` - map discrete values to visual values
- `scale_*_identity()` - use data values as visual values
- `scale_*_manual(values = c())` - map discrete values to manually chosen visual values

X and Y location scales

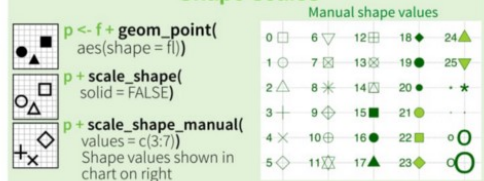
Use with x or y aesthetics (x shown here)

- `scale_x_date(labels = date_format("%m/%d"), breaks = date_breaks("2 weeks"))` - treat x values as dates. See ?strptime for label formats.
- `scale_x_datetime()` - treat x values as date times. Use same arguments as `scale_x_date()`.
- `scale_x_log10()` - Plot x on log10 scale
- `scale_x_reverse()` - Reverse direction of x axis
- `scale_x_sqrt()` - Plot x on square root scale

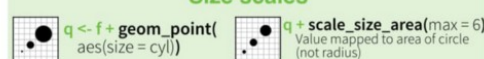
Color and fill scales



Shape scales



Size scales



Coordinate Systems

- `r <- b + geom_bar()`
- `r + coord_cartesian(xlim = c(0, 5))`
xlim, ylim
The default cartesian coordinate system
- `r + coord_fixed(ratio = 1/2)`
ratio, xlim, ylim
Cartesian coordinates with fixed aspect ratio between x and y units
- `r + coord_flip()`
xlim, ylim
Flipped Cartesian coordinates
- `r + coord_polar(theta = "x", direction = 1)`
theta, start, direction
Polar coordinates
- `r + coord_trans(ytrans = "sqrt")`
xtrans, ytrans, limx, limy
Transformed cartesian coordinates. Set extras and strains to the name of a window function.

- `z + coord_map(projection = "ortho", orientation = c(41, -74, 0))`
projection, orientation, xlim, ylim
Map projections from the mapproj package (mercator (default), azequalarea, lagrange, etc.)

Position Adjustments

Position adjustments determine how to arrange geoms that would otherwise occupy the same space.

- `s <- ggplot(mpg, aes(fl, fill = drv))`
- `s + geom_bar(position = "dodge")`
Arrange elements side by side
- `s + geom_bar(position = "fill")`
Stack elements on top of one another, normalize height
- `s + geom_bar(position = "stack")`
Stack elements on top of one another
- `f + geom_point(position = "jitter")`
Add random noise to X and Y position of each element to avoid overplotting

Each position adjustment can be recast as a function with manual **width** and **height** arguments

- `s + geom_bar(position = position_dodge(width = 1))`

Themes

- `r + theme_bw()`
White background with grid lines
- `r + theme_classic()`
White background no gridlines
- `r + theme_grey()`
Grey background (default theme)
- `r + theme_minimal()`
Minimal theme

ggthemes - Package with additional ggplot2 themes

Faceting

Facets divide a plot into subplots based on the values of one or more discrete variables.

- `t <- ggplot(mpg, aes(cty, hwy)) + geom_point()`
- `t + facet_grid(. ~ fl)`
facet into columns based on fl
- `t + facet_grid(year ~ .)`
facet into rows based on year
- `t + facet_grid(year ~ fl)`
facet into both rows and columns
- `t + facet_wrap(~ fl)`
wrap facets into a rectangular layout

Set **scales** to let axis limits vary across facets

- `t + facet_grid(y ~ x, scales = "free")`
x and y axis limits adjust to individual facets
- "free_x" - x axis limits adjust
- "free_y" - y axis limits adjust

Set **labeller** to adjust facet labels

- `t + facet_grid(. ~ fl, labeller = label_both)`
- | fl: c | fl: d | fl: e | fl: p | fl: r |
|------------|------------|------------|------------|------------|
| α^c | α^d | α^e | α^p | α^r |
- `t + facet_grid(. ~ fl, labeller = label_bquote(alpha ^ .(x)))`
- `t + facet_grid(. ~ fl, labeller = label_parsed)`
- | c | d | e | p | r |
|---|---|---|---|---|
| | | | | |

Labels

- `t + ggtitle("New Plot Title")`
Add a main title above the plot
- `t + xlab("New X label")`
Change the label on the X axis
- `t + ylab("New Y label")`
Change the label on the Y axis
- `t + labs(title = "New title", x = "New x", y = "New y")`
All of the above

Use scale functions to update legend labels

Legends

- `t + theme(legend.position = "bottom")`
Place legend at "bottom", "top", "left", or "right"
- `t + guides(color = "none")`
Set legend type for each aesthetic: colorbar, legend, or none (no legend)
- `t + scale_fill_discrete(name = "Title", labels = c("A", "B", "C"))`
Set legend title and labels with a scale function.

Zooming

- Without clipping (preferred)**
- `t + coord_cartesian(xlim = c(0, 100), ylim = c(10, 20))`
- With clipping (removes unseen data points)**
- `t + xlim(0, 100) + ylim(10, 20)`
- `t + scale_x_continuous(limits = c(0, 100)) + scale_y_continuous(limits = c(0, 100))`